

33. $y = 3x - x^3 + 5$ 2nd der test

5. 1st der test $y = x\sqrt{8-x^2}$

sign of f' with sentence

$$y' = x \cdot \frac{1}{2}(8-x^2)^{-\frac{1}{2}} \cdot (-2x) + \sqrt{8-x^2} \cdot 1 = 0$$

$$\sqrt{8-x^2} \left(\frac{-x^2}{\sqrt{8-x^2}} + \sqrt{8-x^2} = 0 \right)$$

$x - \sqrt{8} \quad + \quad 0 \quad - \quad x \quad - \sqrt{8}$

$-x^2 + 8 - x^2 = 0$

$8 = 2x^2 \quad x = \pm 2$

global min at $x = -2 \quad y = 4$
because y' changes from - to +

global max at $x = 2 \quad y = 4$
because y' changes from + to -

$f' = x \quad x = \pm\sqrt{8}$

max at $x = -\sqrt{8}$
because f' is neg

min at $x = \sqrt{8}$
because f' is neg

Oct 17-9:14 AM

4.4a Modeling and Optimization

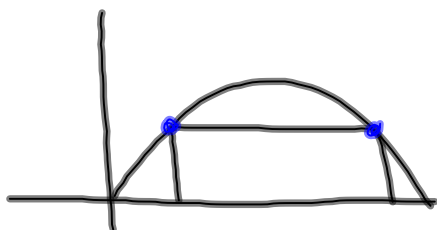
Strategy for solving max/min problems

1. Understand the problem.
2. Use pictures, label variables, constants. Find a function to model the problem.
3. Graph the function. Find the domain that makes sense
4. Find the critical points and endpoints candidate list
 $f' = 0 \quad f' = \text{undefined}$
5. Use the first or second derivative test to identify maximums and minimums.
6. Answer the original question.

Oct 18-6:48 PM

A rectangle is to be inscribed under one arch of a sine curve. What is the largest area the rectangle can have, and what dimensions give that area?

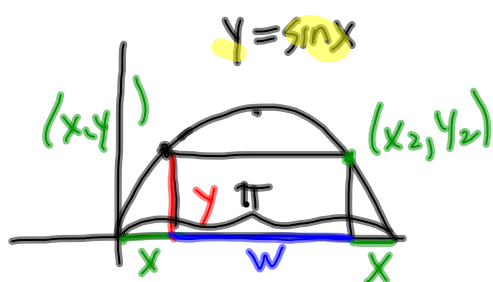
1. guess and check with 4.4 rectangle under sine curve.tns



$$\text{max } A \approx 1.12$$

Oct 18-6:55 PM

Solve using a derivative



$$A = w \cdot y$$

$$A = w \cdot \sin x$$

$$A = (\pi - 2x) \sin x$$

$$\pi = x + w + x \quad \text{and} \quad A' = (\pi - 2x)(\cos x) + \sin x(-2)$$

$$w = \pi - 2x$$

$$x = .7105$$

$$\text{domain } 0 < x < \frac{\pi}{2}$$

$$A = 1.122 \quad \text{max area}$$

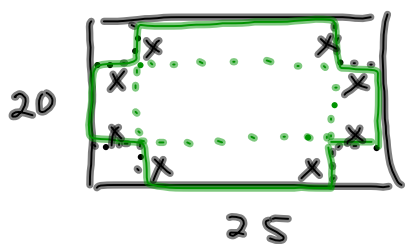
max because
 A' changes from
 pos to neg

$$h = \sin(.7105)$$

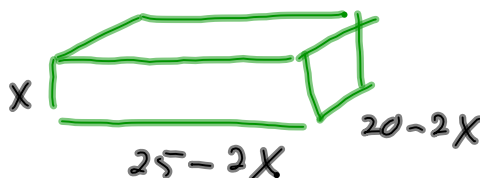
$$w = \pi - 2(.7105)$$

Oct 18-7:13 PM

An open top box is to be made by cutting squares from the corners of a 20 by 25 inch sheet of cardboard and bending up the sides. What is the largest possible volume?



$$V = x(25-2x)(20-2x)$$



$$0 < x < 10$$

$$V' = 12x^2 - 180x + 500 = 0$$

$$x = 3.68119$$

max because

$$V' = 0 \text{ \& \& } V'' < 0$$



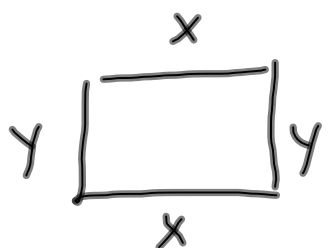
$$\rightarrow V(3.68119) = 820.528$$

$$V''(3.68119) = -91.651$$

Oct 18-7:17 PM

Oct 17-10:27 AM

What is the largest rectangular garden that can be enclosed with 600 feet of fence?



$$0 < x < 300$$

$$2x + 2y = 600$$

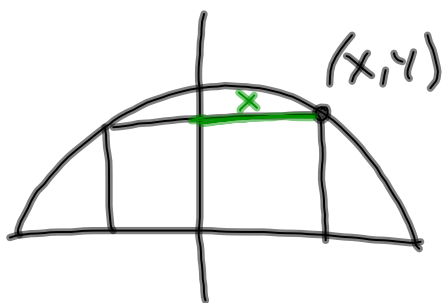
$$x + y = 300$$

max area

$$A = xy$$

$$A = x(300 - x)$$

Oct 18-7:20 PM



$$A = 2xy$$

Oct 17-10:31 AM